

Satellite Communications (c) 1990 IAC

It's still possible to start a small space company, he says. "But the real challenge for a small company in this industry is not in just getting started, but rather it is in finding a growing market niche with a limited number of competitors, securing financing to complete product development and signing the first contracts with anchor tenant customers. With the advent of microspace systems, these new companies may have a better chance of finding such niches and being successful. In any event, I hope they are, because it will be beneficial to the space industry in the long run," he concludes.

GRAPHIC: portrait; Caption: David Thompson. portrait

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Cover Story

SUBJECT:
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NAME:
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LEVEL 1 - 10 OF 53 STORIES

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Business Week

October 29, 1990

SECTION: INFORMATION PROCESSING; Number 3185; Pg. 96

LENGTH: 1514 words

HEADLINE: MOTOROLA: HOW MUCH WILL IT COST TO STAY NO. 1?

BYLINE: Lois Therrien in Chicago, with Peter Coy in New York and Neil Gross in Tokyo

HIGHLIGHT:

The wireless boom has it spending heavily -- as rivals stake claims

BODY:

MOTOROLA IS HOT

IN WIRELESS...

CELLULAR

In the \$5 billion world market, Motorola is No. 1 in cellular phones and No. 2

to Sweden's L.M. Ericsson in switches and other gear. In portable phones, Japan's coming on strong

PAGING

Motorola is No. 1, with 50% of the fast-growing \$1.2 billion worldwide market for beepers. Also operates paging systems abroad

LAND MOBILE

Motorola is No. 1, with 50% of the \$4 billion world market, including two-way radios used by police and fire departments. But sales are shrinking

DATA: COUNTY NATWEST INC.

If there has ever been a company in the right place at the right time, you'd think it would be Motorola. The world is clamoring for wireless communications, and Motorola Inc. happens to have dominant positions in cellular phones, pagers, and two-way radios. While other major corporations were reporting third-quarter earnings that confirmed recession fears, on Oct. 9

Motorola registered a healthy 14.6% jump in net profits. Yet Wall Street dumped the stock that day, lopping off \$ 7, or 12% of its value. Since mid-July, the high-flying shares have plunged roughly 40%, double the decline of the market.

What's wrong? Fear of the unknown. Wall Street is suddenly worried that the Schaumburg (Ill.) company can't keep its perch. Nearly every wireless communications product that put it on top needs to be replaced in the next few years. That will require Motorola to continue plowing huge sums into R&D. It will also provide fresh opportunities for ever-stronger competitors such as Sweden's L. M. Ericsson, Canada's Northern Telecom, Germany's Siemens, Japan's NEC and Fujitsu, and American Telephone & Telegraph. Indeed, investors were stunned because unexpectedly heavy development costs in the third quarter reduced operating earnings in the two divisions that make wireless products, dragging down corporate profits. Company executives say they need to keep

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spending: "What's at stake here is leadership," says Chairman George M. C. Fisher.

LOST BID. Staying No. 1 would almost guarantee Motorola enormous returns. Worldwide sales of wireless products and services are expected to triple to \$ 35 billion in 1995 from just over \$ 10 billion last year, estimates Gartner Group Inc., a market researcher. As the boom takes hold, wireless communications will increasingly overshadow semiconductors at Motorola. Wireless should account for 85% of pretax operating profits and 67% of sales in 1995, up from about 78% and 55%, respectively, this year, estimates Anthony G. Langham, vice-president for County NatWest Inc.

But the wireless market is moving quickly -- and in some cases away from Motorola. Take the kind of private two-way radios used by police, taxicabs, and the military. Motorola has half the \$ 1.2 billion market. But Gartner expects it to shrink to \$ 440 million by 1995 as two-way radios are replaced by cellular phones and shared two-way networks. Motorola is in both markets but is unlikely to match its current 50% share. The company has quietly begun laying off 700 workers in two-way radio. Things are tough in cellular, too: In early October, Motorola lost a key \$ 100 million bid to upgrade the New York-New Jersey cellular network that it installed for McCaw Cellular Communications Inc. The job went to rival Ericsson GE Mobile Communications, an Ericsson and General Electric Co. joint venture.

As the early leader in wireless, Motorola is bound to lose some of its enormous market share as the industry mushrooms. Already its stake in the U. S. wireless market has fallen to roughly half from four-fifths in the past decade, according to International Resource Development Inc., a New Canaan (Conn.) market researcher.

LOW-FLYERS. To keep market-share erosion to a minimum, the company is jumping into new wireless markets as fast as it can. This year, it has launched 10 wireless businesses and started operating mobile services instead of just manufacturing gear for them. Ardis, for example, is a joint venture with IBM that plans to sell handheld data terminals for field staff. The system, conceived for IBM technicians six years ago, is being tested by some 25 companies, including Sears, Roebuck & Co. and New York Life Insurance Co. Otis Elevator Inc. mechanics are testing Ardis' terminals in Chicago.

Motorola's most exotic wireless project is Iridium, a system of 77 low-flying satellites intended to provide mobile phone service to any spot on earth. It's scheduled to go into service in 1996 -- if partners can be found to share the more than \$ 2 billion cost. On Oct. 23, the company is set to unveil plans to bring wireless communications indoors with a radio network for linking computers. It's also working on a wireless office phone system. And its new CoveragePlus service is designed to help truck dispatchers keep in touch with their fleets through a national two-way radio network.

Increasingly, the company is looking overseas and teaming with partners to expand its wireless empire. It has won contracts to build new digital cellular phone systems -- with far greater capacity than today's analog setups -- in four European nations, including Germany and Spain. Japan chose Motorola's design as the standard for its digital cellular system. And Motorola is becoming an operator of wireless services through minority shares in cellular systems in Israel, Hong Kong, Mexico, and Argentina. It owns paging services in

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Australia, Canada, Israel, and Puerto Rico.

After 62 years in wireless communications, Motorola has accumulated the technological knowhow that attracts partners around the globe. ' Motorola's radio expertise is second to none,' asserts John Carrington, managing director of a subsidiary of Britain's Cable & Wireless PLC, which has teamed up with Motorola. With C&W, the U. S. company owns minority stakes in two new wireless phone systems and will supply equipment for both.

Scoring a lot of hits with Motorola's new spray of technology bullets won't be easy, however. First, it could stretch the company too thin and divert critically important funding from its chip unit. And new businesses such as Iridium may not pay off in this decade. With such investments in mind, analysts have cut earnings estimates about 10% in recent months to \$ 4.45 a share for 1990 and \$ 5.29 a share for 1991, according to Institutional Brokers Estimate System.

Most worrisome for the long term: a growing mass market for wireless communications plays to the strength of Japan's electronics giants. ' Motorola is ill-equipped to compete with large consumer-electronics and communications manufacturers . . . who can get volume production and design economies,' argues Stuart Lipoff, Arthur D. Little Inc.'s vice-president for advanced electronics technology.

While Motorola has been unusually successful in selling cellular phones and beepers in Japan, the Japanese have been even more successful in the U. S. Combined, Japanese companies have more than 50% of the U. S. cellular phone market, vs. Motorola's 20%, estimates Michael Jeremy of Baring Securities in Tokyo. And that's just the start. Fujitsu is hard at work on wireless PC networks, while Kokusai Electric Co. is working on wireless stock-display terminals for crowded trading rooms.

Motorola also runs the risk of alienating some customers as it diversifies into running wireless systems. New York-based Millicom Inc. says it probably will not buy equipment from Motorola to build the personal communications networks, a new kind of cellular, it plans for Orlando and Houston next year. One reason: The two companies belong to competing consortiums running PCN systems in Britain, says Chairman J. Shelby Bryan. ' Customers don't like to see you as a competitor,' warns Ake Lundqvist, president and chief executive of Ericsson GE Mobile Communications.

WORLDLY. Fisher dismisses the sudden rash of doomsaying. He insists that Motorola can separate its roles as supplier and competitor and will avoid overreaching by enlisting partners. In addition to IBM and Cable & Wireless, Motorola has partners ranging from the Irish phone company to Hong Kong's Hutchison Whampoa Ltd. ' We aren't so brazen as to think we can do it all alone,' Fisher says. And even as competition mounts, Motorola has formidable strengths: decades in radio technology, the No. 4 semiconductor operation in the world, and experience in dealing with governments around the world -- an asset when new wireless services require allocation of scarce radio spectrum.

Fisher remains confident that the company will prevail in the long run. He points to Motorola's investment in the first generation of cellular: As the company pumped in \$ 100 million over 10 years, critics on Wall Street and elsewhere urged it to abandon the project. But Motorola's doggedness paid

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off. It expects \$ 2 billion in cellular sales this year. Now, with the stakes and investments rising, Fisher will need that kind of grit -- and more -- to make his newest wireless initiatives fly.

GRAPHIC: Photograph, TESTS OF THE MOTOROLA -IBM HANDHELD TERMINAL ARE BEING CONDUCTED BY OTIS ELEVATOR MICHAEL L. ABRAMSON; Graph, ...BUT INVESTORS HAVE TURNED COLD

Data: Bridge Information Systems, Inc. ERIC HOFFMANN/BW

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LEVEL 1 - 11 OF 53 STORIES

Copyright 1990 Warren Publishing, Inc.
Communications Daily

October 26, 1990, Friday

SECTION: Vol. 10, No. 208; Pg. 7

LENGTH: 483 words

BODY:

Pacific Satellite Inc. (PSI), owner of Pacstar regional Asia/Pacific communications satellite system, and International Telecommunications Development Corp. (ITDC), subsidiary of Directorate Gen. of Telecommunications (DGT) of Taiwan, have signed memorandum of understanding (MOU) under which organizations will begin marketing Pacstar transponders in 1993 (CD Oct 30/1989 p2). PSI Vp Kim Degnan said "several . . . telecommunications authorities" and "number of potential users" have been waiting for MOU. She said next step is to complete user requirement analyses, contractual commitments for transponders, customized satellite specification for Pacstar 1. Degnan said Pacstar can meet most design requirements at competitive price: "But the window closes tight at the end of the 6-month marketing period." PSI said it's considering several manufacturers for 1,250-1,400-kg satellite to be ready no later than 30 months after procurement. It's also considering "expedited approach" with 10-12 transponder lightsat.

Motorola's efforts to convince Japanese communications equipment manufacturers and trading firms to participate in joint development and financing of \$20-billion Iridium mobile satellite communications system have been met with skepticism, Japan Economic Review said. Japanese firms reportedly question whether sufficient demand exists, since 95% of calls made from portable phones are to destinations within 100 km, and users average one international call per year. However, Motorola source said 2 of 3 major Japanese trading houses are interested. Spectrum availability and govt. regulatory hurdles also will be problems, report said.

Inmarsat said first of its next-generation satellites is ready for launch Oct. 30 on Delta rocket from Cape Canaveral. Bird is scheduled for liftoff at 6:16 p.m. EST. Spacecraft, first of 4, was mated with launch vehicle Tues. Inmarsat 2 will provide L-band mobile communications to earth stations small enough to be hand-portable. Second bird is scheduled for Delta launch in Feb., and 3rd and 4th will be orbited by Ariane boosters next July and Nov.

N. American Quotations (NAQ), London, Ont., has selected Microspace Communications, Raleigh, to provide VSAT services to replace existing satellite network. Network, with 30" dishes, will be used with Trendsetter equities and commodities quotation system, which ADP Brokerage Services Group recently sold to NAQ for undisclosed amount. NAQ will operate Trendsetter from new offices in Stamford, Conn. ADP Vp Ron Williams has been named NAQ gen. mgr.

Atlantic Satellite Communications, Northvale, N.J., has begun using new TV fiber cable with digital/laser transmission system. CBS started using system Sept. 9, downlinking football game from Tampa to TV Bcst. Center in N.Y. BBC, BrightStar, Reuters and Visnews also have signed contracts to use system, Atlantic said.

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LEVEL 1 - 12 OF 53 STORIES

Copyright 1990 Facts on File, Inc.
Facts on File World News Digest

October 26, 1990

SECTION: UNITED STATES; Telephones

PAGE: Pg. 796 F2

LENGTH: 375 words

HEADLINE: Motorola Sets Global Cellular Plan

BODY:

Motorola Inc. June 25 announced a plan to develop a system of satellite-linked portable telephones able to transmit and receive calls from anywhere in the world.

The system would entail the launching of a network of 77 low-orbit communications satellites that would relay the signals from phone handsets. The handsets would weigh about 25 ounces (776 grams) and be priced at less than \$3,500. Motorola said the venture would cost a total of about \$2.3 billion and could be in place as early as 1996.

Current portable cellular phones could be purchased for as little as \$400. But their use was limited to areas in which radio networks that transmitted their signals had been installed.

Motorola said its system, dubbed "Iridium," would be compatible with existing cellular phone systems. Projected users included professionals working in developing countries, travelers through rural sections of the U.S. and passengers on ships and airplanes. Although GTE Corp. made a system that allowed calls to be made from jets, it still could not receive calls from the ground.

Iridium, to be launched in 1992 with the placement of two satellites as a preliminary test, faced significant regulatory, competitive and financial hurdles. Motorola would have to seek the approval of the Federal Communications Commission and other international bodies for the new network and the frequency it would use.

Iridium's high cost meant that Motorola would only be able to finance about 20% of the system on its own. The company said it had held talks with some major satellite firms about a possible partnership in the venture. The firms included American Mobile Satellite Corp., Telesat Mobile Inc. of Canada and the International Maritime Satellite Organization.

Many analysts expressed doubts about the demand for the system, which Motorola said would need to attract a minimum of 700,000 users to break even. They said the price of the handset, as well as a projected cost of up to \$3 per minute to place calls, gave the system a significant cost disadvantage in comparison with established cellular systems.

Others noted that Motorola had a strong reputation in land-and space-based communications and said the system had a good chance of success.

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Communications Daily

OCTOBER 25, 1990, THURSDAY

SECTION: Vol. 10, No. 207; Pg. 5

LENGTH: 404 words

HEADLINE: Large Companies Moving In;
OSC OFFICIAL SEES TREND TOWARD MORE SOPHISTICATED SMALLSATS

BODY:

Small satellites are evolving toward highly sophisticated systems as demands on platforms become more "rigorous" and operators seek to use birds for new applications, Orbital Sciences Corp. (OSC) Senior Vp Gilbert Rye said. Speaking at Space Conference in Washington Tues. hosted by Technical Mktg. Society of America, Long Beach, Cal., he said business opportunities for smallsats (spacecraft of 500 lbs. or less) are "promising," provided current low-cost advantage is maintained and capabilities are expanded to include wider range of mission types.

Larger aerospace companies are planning to compete with small ones already involved in business, Rye said, with focus on high end of market, including communications satellites, which now account for 61% of smallsat contracts. Other smallsat applications so far are: (1) Space physics, 13%. (2) Remote sensing, 9%. (3) Unknown, 16%. Of smallsats deployed, he said 58% were to establish "proof of concept," 22% involved other experiments, remainder is unknown. He said major satellite manufacturers such as Ford and Hughes are "watching market" before getting involved.

Business still is dominated by Defense Dept., Rye said, with Defense Advanced Research Projects Agency (DARPA), Navy and Air Force leading way. He predicted near-term domination of business by Pentagon, but said private sector is coming on strong. Launch of Motorola's 77-satellite Iridium constellation and Orbcomm's low-earth-orbit system will alter way market is divided, he said. Of contracts signed since 1988, Rye said 93.9% were Defense related, 4.6% civil, 1.5% commercial. He predicted "near reversal" of number of commercial vs. defense smallsat contracts.

In last 3 years, 17 contracts were awarded for smallsats, representing 31 birds and \$75 million in revenues. Rye said 59 organizations are building or planning to construct smallsats, 38 of them in U.S. He said 9 already are under contract. He said competitors in future will have to exploit "distinguishing advantages" of systems, such as cost, flexibility, responsiveness, "staying power," integrated systems, other qualities. International market potential is "very unknown," Rye said. He said it's 2 years behind U.S. level of development, but forecast that when foreign companies see delivery potential of low-cost launch systems -- reference to OSC's air-launched Pegasus booster -- overseas markets will grow.

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LEVEL 1 - 14 OF 53 STORIES

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The Washington Post

October 24, 1990, Wednesday, Final Edition

SECTION: FINANCIAL; PAGE G1

LENGTH: 679 words

HEADLINE: Motorola Enters Wireless Computer Market

SERIES: Occasional

BYLINE: Evelyn Richards, Washington Post Staff Writer

BODY:

One by one, the umbilical cords of the electronic age are being cut.

First came walkie-talkies, then beepers, then cellular phones. Now come wireless computers, the latest gear designed to eliminate the notion that those doing the communicating can't move around at will.

Motorola Inc. yesterday joined a handful of other companies in announcing its plans to explore ways for computers to send and receive data over radio waves, without requiring physical hookups to cables or phone lines.

The company's "wireless in-building network" technology is designed to enable computer users within a building to move from place to place without having to string new wire or sit near a cable connection to stay linked to other terminals on the office's central data communications network.

The idea is similar to a scheme Apple Computer Inc. sketched out in a filing with the Federal Communications Commission earlier this month that would allow portable-computer users to form ad hoc groups and communicate over radio waves instead of cable.

Under Apple's plan, a college student relaxing in a lounge might access the computerized card catalogue of the school's library. Or people attending a sales staff meeting in a hotel ballroom might zip their financial projections through the air to one another's computers.

The ideas outlined by Motorola and Apple, as well as a similar product announced by NCR Corp., are just the latest additions to the wireless world now taking shape. "The bigger picture is to provide as much communications capability as possible to anyone, anywhere, anytime... . The whole point is communications will be where the person is rather than the person going to where the communications is," said Henry Goldberg, a Washington telecommunications attorney who represents Apple and other companies.

Thus the images once confined to science fiction draw closer to reality: Chatting on a pocket phone as you walk down a busy street, sending in a lengthy report while sunning on the beach, receiving a fresh map while driving to an appointment.

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The Washington Post, October 24, 1990

The system described by Motorola yesterday would handle just the last few feet of data communications within a building. The company has in mind turning a building into a cluster of invisible "micro-cells," a small-scale version of the way cellular phone providers divide up the landscape into geographic units.

Computers would be equipped with high-frequency transmitters and receivers so that users could freely move them around a building, forgoing the \$ 200 to \$ 3,000 Motorola says it can cost to rewire a desk for a computer. The company plans to offer products using the technology next year.

Motorola has already made it over one major hurdle -- that of winning from the FCC the rights to use certain frequencies in the increasingly crowded spectrum of airwaves. By grabbing frequencies not normally used for commercial services, Motorola said it has been able to secure the rights to such in-building wireless networks in roughly 300 areas of the country.

Motorola's stock rose 12 1/2 cents yesterday in response to the announcement.

Introduction of the networks is the latest of several moves by Motorola to shore up its position in wireless communications. The company's most ambitious undertaking is Iridium, a proposed network of 77 satellites that would allow people to make and receive phone calls from remote locations anywhere in the world.

After watching its dominant share of the "wireless" area being nibbled away by competitors over the last decade, Motorola has finally made "a vigorous attempt to make sure it is at least doing something in every wireless market," said Ken Bosomworth, president of International Resource Development Inc., a New Canaan, Conn., consulting firm.

Apple's interest in the wireless market has more to do with its struggle to find an acceptable way to connect computers in large companies. A wireless capability could allow Apple to reassert itself in the corporate PC network market, he said, but added, "I don't think they stand a prayer."

GRAPHIC: ILLUSTRATION, PETER ALSBERG

TYPE: NATIONAL NEWS

SUBJECT: ELECTRIC & ELECTRONIC EQUIPMENT INDUSTRY; PRODUCT DEVELOPMENT

ORGANIZATION: MOTOROLA INC.; APPLE COMPUTER INC.; NCR CORP.

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LEVEL 1 - 15 OF 53 STORIES

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Japan Economic Journal

October 20, 1990

SECTION: INDUSTRY: INFORMATION; Pg. 15

LENGTH: 941 words

HEADLINE: Motorola seeks satellite 'boosters';
Japan firms show little interest in joining global communications net

BYLINE: By KYOKO ITOH, JOURNAL STAFF WRITER

BODY:

Motorola Inc. has been trying to connect with its Japanese counterparts in the development of a revolutionary digital cellular phone system. But just about all the U.S. firm has been getting from across the Pacific so far is busy signals.

The firm recently announced it has been working on a satellite mobile telecommunications system which would enable the use of portable digital cellular phones just about anywhere on earth and in the sky.

Motorola has made intensive efforts to convince Japanese communications equipment makers, trading firms and others to participate in joint development and financing of the \$ 20 billion system, reportedly with little success.

'Constellation' of satellites

The system, centered on 77 satellites arranged in a "constellation" around the globe, is called Iridium, after the element with 77 electrons orbiting its nucleus.

The satellites would link to form a digital communications network ten times more powerful in voice and data processing capacity than existing conventional cellular phone systems, according to officials at Motorola.

Because the satellites would be in low orbits of 764 kilometers, compared with the 35,800km of stationary-orbit satellites, small 600-milliwatt phones will be sufficient for worldwide calls, claim the officials. The phones would be similar in size to Motorola's Micro Tac, the world's smallest portable cellular phone.

Motorola expects at least 10 million users worldwide, with the majority based in developing countries and remote regions lacking conventional cellular phone systems. Iridium will cost less than establishing a conventional telephone network, the officials say, although actual monthly service rates would be slightly higher.

The estimated cost of \$ 20 billion includes 102 ground stations and the 77 small satellites. Motorola is aiming at a startup date of 1996, and is negotiating with governments and private firms of more than 30 nations over satellite operation and financial participation.

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1990 The Nihon Keizai Shimbun, JEJ, October 20, 1990

"Iridium is a magnificent dream," says Shig Sando, deputy general manager of Nippon Motorola Ltd.'s communications division. "I believe it will be realized in the near future since it is made up largely of conventional technologies."

Cool reaction

However, Japanese firms are skeptical about the whole idea.

"I wonder if enough demand exists," says an official at a mobile telecommunications firm who declined to be identified. "For instance, 95% of the calls made from portable phones are to destinations within 100 kilometers from the caller. Users make international calls only about once a year," he says.

The official also says the expense would be too much for users in developing countries to handle. Motorola hopes to keep its rates lower than those of the International Maritime Satellite Organization (Inmarsat), which charges about ¥1,000 a minute, but the cost will still be higher than local network services.

Adds a source at a major Japanese telecommunications equipment manufacturer, "The system would be meaningless in remote areas, where users would be able to make international connections but not make calls to the next village because of a lack of conventional phone systems."

Tadashi Onodera, director of DDI Corp.'s engineering department, says, "Iridium may be useful for military purposes, but not for commercial use because it would be very difficult to earn profits."

A source at Motorola says two of the three major Japanese trading houses are expressing interest in participating, although the traders refuse to comment.

Myriad of obstacles

Although most of the Iridium project is anchored in conventional technologies, some exceptions exist. For one, the coordination of communications traffic between satellites and earth stations will be extremely complicated, a source at a major telecommunications equipment maker points out. However, Motorola officials deny this is the case.

Also, Motorola must deal with the legal and technical requirements established by each country in which it wants to operate the system. In Japan, that means getting the approval of the Ministry of Posts and Telecommunications.

Another big hurdle is availability of the 1-3 Gigahertz frequency band, which Motorola intends to use to relay calls through Iridium. "The band is already occupied in Japan and most other countries," says Shigeyuki Kubota, deputy director of the ministry's telecommunications bureau. "We have been making an effort to shift current users of the band to make room for land telecommunications and stationary-satellite communications. But no provisions are being made for Iridium because, unlike Inmarsat, it is not yet known which firms would actually operate the Motorola system. No international consensus has been reached regarding Iridium."

1990 The Nihon Keizai Shimbun, JEJ, October 20, 1990

Last but not least is the huge amount of initial investment, as well as maintenance costs and the finances required to replace the satellites at the end of their lifespan.

However, Motorola may get the Iridium project off the ground through a tie-up with Inmarsat, possible early next century, when the lifespans of the third-generation Inmarsat satellites expire, say analysts. They point out that Inmarsat has agreed to a joint study with Motorola on the feasibility of Iridium.

Inmarsat also as the options of setting up its own communications network using low-orbit satellites, or launching a fourth generation of stationary-orbit satellites, according to industry observers. It could make a decision by next June, when the Iridium feasibility studies are scheduled to be completed.

GRAPHIC: Picture, Flock of low-flying satellites would relay calls anywhere on the earth.

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Communications Daily

OCTOBER 19, 1990, FRIDAY

SECTION: Vol. 10, No. 203; Pg. 7

LENGTH: 838 words

HEADLINE: Getting Spectrum Is Key;
INDUSTRY OFFICIALS PREDICT HUGE GLOBAL MOBILE SATELLITE MARKETS

DATeline: LAS VEGAS

BODY:

Officials' market predictions for Mobile Satellite Service (MSS) were unanimously bullish here Wed., with global networks, formation of international consortia and new aeronautical (AMSS), land (LMSS) and maritime (MMSS) applications envisioned. Industry leaders, addressing issue of expanding markets for MSS at closing session of Satellite Communications Users Conference (SCUC), said however that some consolidation of contenders is inevitable.

Panel members included Tom Bernard, vp, OmniTracs Div., Qualcomm; Steve Cheston, exec. vp, Geostar; Durrell Hillis, gen. mgr., Motorola; Gary Noreen, pres., Radio Satellite Corp.; Alan Parker, pres., Orbital Communications (Orbcomm). With exception of Qualcomm, which already has Ku-band LMSS system in U.S. and Western Europe, companies they represented are planning to launch MSS systems.

There will be "substantial consolidation" of players in MSS industry, which recently has seen unprecedented number of proposals to FCC for new systems, Noreen said. "Falling out" will be based largely on cost of services and user acceptance. He predicted that success would come to companies that integrate combinations of voice, data, messaging and positioning in small, inexpensive receivers. Finding mass markets is key, Noreen said, so manufacturers can achieve economies of scale and lower prices. As for proliferation of standards for terminals and compatibility of equipment across systems, he said "market will decide" industry direction. Noreen is one of 8 directors of American Mobile Satellite Corp. (AMSC), which plans to launch MSS system in 1993. He said AMSC projects that service will cost \$2 per min. if steerable antenna is used, \$4 per min. with omnidirectional unit.

Parker said there's room for all MSS competitors. Citing "large, underserved" markets, he said MSS applications as yet unidentified could create global markets that are "enormous." Of existing offerings, he said biggest U.S. market may be emergency services, and messaging may be top earner in international field. Parker agreed with Noreen that future systems will offer "hybrid" combinations of services. Orbcomm is to provide global network of 2-way data, particularly to LMSS users. Parker said he expects terminal to cost \$150, with installation, antenna and other costs to customer \$75.

Iridium, global low-earth-orbit MSS system proposed by Motorola, eventually will compete with voice services provided via geostationary satellites, Hillis said. Service would cost \$3 per min., he said, with base of 700,000 subscribers. In estimating size of MSS market, he said Motorola

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expectations are based on company's experience with cellular markets: "We grossly underestimated the [demand for] cellular service." Hillis said global market for voice is "huge," with 70% of countries in need of simple communications services. In just 2 countries -- Mexico and Spain -- there are 100,000 and 70,000 unserved villages, respectively, and there are far more in India. He agreed with Noreen that there will be some "shakeout" among service providers, "but the real issue is spectrum" availability.

Bernard compared panel's task of predicting MSS potential with computer conference in 1950s. He said executives then couldn't have guessed extent of service and product diversity made possible by rapid advances in field. Nonetheless, Bernard ventured prediction that there would be "blending" of MSS and computer technologies: "It's hard for any organization in this business to have enough imagination to think of all the possible applications."

Acquiring MSS spectrum will be "push-and-shove contest," Cheston said, referring to frequency allocations scheduled for discussion at 1992 World Administrative Radio Conference (WARC). Cheston, whose company will be seeking L-band, said "political process in WARC is what it gets down to." Hillis agreed, but said he was confident that MSS industry would receive bandwidth allocations because decisions would be "market driven." SCUC Notebook . . .

R.L. Drake, Miamisburg, O., demonstrated Video Scrambling Transmission Algorithm (VISTA) at SCUC. Medium-security system is aimed at business, industrial, financial and educational users with networks of 100-50,000 reception sites. Encoder and integrated receiver decoder for 100 sites costs \$75,000, Drake said.

Vitacom Corp., international satellite communications company, Mountain View, Cal., introduced communications processor for multiple channels for point-to-point, point-to-multipoint or "full mesh" applications. Company said unit, Integrated Services Digital Terminal, is compatible with plug-in cards for voice, fax, data.

SSE Technologies, manufacturer of satellite terminal equipment, Fremont, Cal., has been awarded \$2 million contract by Telesat Canada to provide 200 terminals over next 3 years. SSE said it also has opened office in Washington, D.C., with William Brewster as regional mgr.: 1801 Robert Fulton Dr., Suite 400, Reston, Va. 22091. Phone: 703-715-0612.

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LEVEL 1 - 17 OF 53 STORIES

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The San Francisco Chronicle

OCTOBER 16, 1990, TUESDAY, FINAL EDITION

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HEADLINE: CELLULAR SUCCESS STORY
Moving Beyond the Car Phone Fad

BYLINE: Carl T Hall, Chronicle Staff Writer

BODY:

Shedding their image as yuppie toys, cellular telephones have become electronic umbilical cords for workers on the move -- and now are poised to break into the mass consumer market.

Lower prices, better service and advanced technology promise to usher in a new era of wireless communications.

"There are some very fundamental changes happening in our society, perhaps even globally, that put a premium on being able to communicate while you're on the move," said Sam Ginn, chairman and chief executive of San Francisco-based Pacific Telesis Group, parent of Pacific Bell and a separate cellular unit, PacTel Cellular.

A recent survey commissioned by NYNEX Mobile Communications Co., the biggest cellular company in the Northeast, concluded that as many as 31 million Americans will be using mobile phones by 1995. Slightly more modest projections by independent financial analysts put the figure as high as 25 million, or about 10 percent of the U.S. population. Right now the total is less than 5 million.

The possibilities are mind-boggling. With such promised features as selective call-forwarding and electronic message-taking, people may be able to go through life with a single telephone number of 10 digits or so. They could make and receive calls on the beach, for example, but could block unimportant incoming calls while soaking up the sun.

Cellular phones -- so called because signals are transmitted within specific geographic areas, or cells, by radio towers -- were introduced about seven years ago. Towers have been built throughout most urban areas to provide blanket coverage, and the systems are rapidly being expanded nationwide.

The towers shuttle signals between mobile phones and the regular land-line wire system. When a caller moves from one cell to another, the first tower quickly hands off the call so the conversation can continue without interruption. Although many rural areas still lack cellular coverage, industry officials predict that within two years it will be possible to drive across the country without any break in service.

OUTPACING VCRS

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1990 The San Francisco Chronicle, OCTOBER 16, 1990

Cellular grew faster in its infancy than any other electronic products, including VCRs, pocket calculators and color television. Those other products went on to invade nearly every home in the country.

'Cellular of tomorrow will be as important to consumers as land-line is today,' said Rhonda Whickham, editor of Cellular Business, a Kansas City-based trade publication. 'It's evolving very quickly.'

Wireless telephone technology has made astonishing gains. A key development is the introduction of smaller, lightweight phones that can be used without installation in a car, where the battery supplies the power. Although visions of ordinary people conversing on Dick Tracy-style wristphones are premature, portable phones that fit comfortably in a purse or shirt pocket are available and may soon be commonplace.

The popularity of cellular telephones is growing even faster. Between June 1988 and June 1990, the number of cellular systems increased from 420 to 592, while the number of subscribers rose from 1.6 million to 4.4 million.

During the first six months of this year, the number of subscribers increased 24.5 percent. That growth was impressive in light of weakness in the economy and especially deep slumps in construction and real estate, both highly mobile industries that have proven to be key cellular customers.

JUST THE FIRST PHASE

As rapid growth continues, the existing cellular system is shaping up as merely the first phase of the wireless network. Companies and government regulators are looking into other technologies that might greatly extend the reach of mobile telephones before this decade is out.

* Motorola Inc. has announced plans for a 77-satellite radiotelephone system. Named Iridium, after the atomic element with 77 protons, the system would bring space-age communications to the most remote regions of the globe by 1996, if the plans work out.

* The Federal Communications Commission is studying an experimental type of system known as 'son of cellular.' Called 'personal-communications networks' or 'PCN' in industry jargon, these systems might take the place of ordinary pay phones, except that users would carry their own portable handsets to tap into a common terminal. Some versions, known as 'Telepoint' service in Great Britain, work only for outgoing calls. Transmitters probably would be installed at busy downtown street corners, airports and public buildings.

Exactly which of the various technologies will catch on depends on FCC decisions and the luck of companies competing for a slice of the market. Then it is up to consumers.

Warren Gifford, division manager for wireless services at Bell Communications Research in Livingston, N.J., says all that appears certain is that there will be 'a whole variety of different systems' working at once.

'The basic technology for most of these things is there already,' he said. 'The challenge will be to get the network to interconnect all of them.'

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Lee Cox, chief executive of PacTel Corp., the Telesis subsidiary that includes PacTel Cellular, said that mobile telephones will never replace the ubiquitous land-line system, built during the past century. Instead, he foresees a "robust" parallel network. "Every application you can find on the wired network today, for voice or data or video, is going to be possible wireless," he said.

THE CALIFORNIA MARKET

California's strong economy, trend-conscious culture and chronic traffic jams make it an especially fertile proving ground for cellular phones. More than 500,000 customers have signed up so far in the state -- far more than anybody had predicted for this stage -- with Los Angeles the world's biggest cellular market.

In terms of percentage of the population using cellular, the Bay Area is one of the top markets in the country, with about a 3.3 percent share. That compares with 3.1 percent in Los Angeles, 3.4 percent in Chicago and 1.7 percent in New York. In the Washington area, with its high concentration of government officials and lobbyists, 4.2 percent of the population has signed on.

To tap a mass market, cellular companies will have to add far more capacity to their systems. San Francisco-based Telesis, among others, is moving rapidly to an all-digital computerized switching network that expands capacity tenfold. Without digital switching and new capacity for growth, the cellular airways soon would become as hopelessly clogged as the freeways that helped fuel the industry's growth.

The transition to digital adds another roadblock: New phones will have to cope with two types of switches for a few years. This probably means that handsets will get bigger and more expensive before they get smaller and cheaper again.

TIME TO SHRINK

However, once all networks are digital, the equipment can shrink. And that's when the industry hopes demand will really start booming.

Mitsubishi International last month introduced the most compact portable phone yet -- the 10-ounce Model 3000, which has the look and feel of a TV remote-control device. It lists for \$ 1,499, but Mitsubishi expects retail discounts to bring the price down to about \$ 1,000.

Panasonic Communications & Systems Co., a unit of Matsushita Electric Industrial Co., said it will market an ultracompact, 13.4-ounce cellular phone next month that is only slightly larger than Mitsubishi's. Panasonic's phone comes with a suggested list price of \$ 1,200.

Both models have drawbacks. They require recharging after 80 or 90 minutes of talk time, for example. Users can get about an hour of extra time if they are willing to spend about \$ 100 more for a deluxe battery pack.

Keypad buttons on these miniphones are small and hard to use. Also, the units are small enough to be easily lost -- and expensive enough to be worth stealing.

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Although they contain speed-dialing, electronic-function menus and other improvements that distinguish them from most hand-held cellular phones -- some of which sell for less than \$ 400 -- the sleek new models are clearly not the last word in miniature phones.

'Probably the ideal portable phone would be the size of a fountain pen,' said Mitsubishi product manager Jeff Nelson. 'I suspect that's a long way off.'

THE WAY WE TALK: TODAY AND TOMORROW

There are three fundamental ways to communicate by telephone. Three developments that will greatly expand calling opportunities are in the works.

CURRENTLY IN USE

- * Land-line: The regular, century- old phone system that connects callers to a central network by copper wire or fiber optic cable.

- * Cordless phones : Part of the regular land-line system, except that handsets are detached from the phone and transmit signals over short distances to a base station.

- * Cellular : Wireless phones, mostly used in cars, although small hand-held models are gaining popularity. A radio tower collects signals within a specific area, or cell, and relays them to a telephone-company network to complete calls. Users can also receive calls and can call other mobile-phone users. Towers hand off calls to one another so users can keep talking when they travel beyond a cell boundary. Subscribers can use their cellular phones in any of 306 urban areas in the United States, but there are gaps in many rural areas.

STILL BEING DEVELOPED

- * Telepoint : Already introduced in Europe. Callers use pocket phones to place calls through low-power transmitters stationed in busy areas, such as airports and train stations. Equipment is inexpensive, but users can only place calls, not receive them, and they must be near a transmitter.

- * PCN: Personal-communications networks, similar to Telepoint except that they could accept calls. U.S. regulators are in the early stage of an attempt to assess the need for PCN in the United States and determine how to allocate the radio spectrum for such systems.

- * Satellite: Motorola has proposed a system of satellite-fed radiotelephones that would work much the way cellular does, but on a global scale. Even remote regions of the world would be reachable through direct dialing.

CHART

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CELLULAR'S RAPID GROWTH

The U.S. cellular industry added 860,000 subscribers during the first six month of this year, a 24.5 percent increase over December 1989. Employment in the industry grew 19 percent.

• Subscribers

• Cellular systems in U.S.

• Industry revenues

• Employees

EC:

GRAPHIC: CHART: SEE END

TYPE: RELATED STORY, SPECIAL REPORT: ENTERPRISE COL

SUBJECT:

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LEVEL 1 - 18 OF 53 STORIES

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October 15, 1990, Monday

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HEADLINE: International Mobile Communications 8;
A boon for remote callers - Mobile satellite networks

BYLINE: MARK NEWMAN

HIGHLIGHT:
Report by Mark Newman

BODY:

WHEN EDMUND HILLARY and Sherpa Tensing reached the top of Mount Everest 37 years ago, news of their success took several days to reach the outside world. But in a few years from now, they would be able to switch on their mobile satellite telephone and tell us all just as soon as they got their breath back.

With most of the globe now within reach of telecommunications satellites, the technology is being developed to construct mobile telephone networks that can be used in the most remote places. This is helping seafarers, long-distance lorry drivers, international rescue teams at the scene of natural disasters and journalists.

Several international companies believe that this market for remote area communications is big enough to support their presence. But with terrestrial cellular networks steadily expanding into territory that mobile satellite operators once considered their own, there must be some doubt about future prospects for satellite services.

These differ from terrestrial networks in the way their signals are directed. In the satellite system, the radio signal emitted by the phone is bounced into the public network off a geostationary satellite 33,000 km above the ground. A call on a terrestrial cellular network is transmitted no more than a few kilometres to a base station connected to the fixed network.

The largest market for mobile satellite networks has been in the shipping industry. Most large vessels already use the satellite communications services provided by the International Maritime Organisation. Known as Inmarsat, this is a 57-member country co-operative set up in 1972 to serve the telecommunications requirements of cargo and passenger ships.

Equipment is bulky and expensive. It costs Dollars 30,000 to equip a ship with full Standard-A Inmarsat voice and data systems. For an oil tanker with a multi-million dollar cargo, this is not exorbitant. But for other kinds of ships it is a significant cost.

Fortunately for them, cheaper and more compact mobile satellite equipment is becoming available. It will soon be possible to buy data only equipment for Inmarsat's new Standard-C system for less than Dollars 5,000.

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Financial Times, October 15, 1990

This service also has possible applications in the long-distance haulage business. STC, the UK electronics company, has introduced a personal data communications system which fits into a briefcase for travellers who want to use Inmarsat-C. Known as a Mascot Nomad, the system includes a small dome-shaped antenna and transceiver, an IBM compatible lap top computer and a small printer. It can also be fitted in the cabin of a lorry.

The US-based Qualcomm has had considerable success with its Omnitrac mobile data service among US haulage operators. Capable of covering the whole of the US, it enables a driver to receive all the details of his next job without having to leave his cabin in search of a public call box. Companies claim it can save up to two hours a day of the drivers' time.

Satellite technology is also becoming available in the aircraft passenger cabin. The days when the international businessman could relax on a long flight from a meeting could soon end if services are developed to allow him to do the work which would normally have to wait until Monday morning. Instead, he may type reports on a laptop word processor and beam them down to head office with a cordless modem.

This is still some way off, but public telephone services are already available on a limited number of Japanese and US domestic flights. A year ago British Airways fitted two of its aircraft with public telephone services available to credit card holders at Dollars 9.50 per minute. The service relies on Inmarsat to beam the call by satellite down to an earth station where British Telecom then transfers it to the fixed telephone network.

It is the satellite part of the call that makes the service so costly. British Airways pays British Telecom Dollars 6.80 of the Dollars 9.50 that the customer pays, and British Telecom pays a large part of this in turn to Inmarsat. Using satellite is not cheap, and mobile satellite services will not be able to compete on price with cellular systems.

This is why satellite operators must be concerned by the development of cellular services which allow the same phone to be used in more than one country. Until now it has only been possible to use a cellular phone in the country of purchase. The exception is Scandinavia where users have been able to roam between countries. The facility will also be possible in the rest of Europe from next year.

A long-distance lorry driver starting in Sweden will be able to use the same mobile cellular phone during the course of his journey through the UK, France and his final destination in Spain. He will be a subscriber to the pan-European digital cellular system scheduled for launch next July and which allows the user to make calls in all West European countries. Eventually the facility will spread to Eastern Europe, with North Africa and Turkey possibly following at a later date.

In the US, where cellular operators only have regional licences, McCaw Cellular, an operator in Washington, is buying up other regional licences to construct a seamless network which will be able to offer coverage in most states. Other regions, such as the Asean countries in south-east Asia, also be able to introduce roaming agreements so that the same cellular phone can be used anywhere.

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Financial Times, October 15, 1990

All these networks will be cheaper to use than land mobile satellite systems, whose only chances of competing in these markets is if users need communication in remote regions where the terrestrial systems do not provide coverage. Although all the cities and main roads will be covered in the pan-European digital cellular network, it will not be possible to use the phones in more remote areas.

Satellite systems will complete the global communications jigsaw by filling the remaining gaps once fixed and cellular systems are complete. They will be invaluable to many, but unless their price starts to rival those of cellular systems, they will remain a niche market in which there is only room for a few international players.

Motorola announced plans earlier this year for what could be the last word in mobile satellite communications networks. Iridium, as its service has been named, will be a global communications service using handsets no bigger than many of the cellular phones now on the market. But it will cost Dollars 2bn to build the network, and at least 700,000 subscribers, each paying Dollars 3,500 for the handset and Dollars 100 per month airtime will be needed if it is to break even.

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LEVEL 1 - 19 OF 53 STORIES

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HEADLINE: ELECTROMAGNETIC SCIENCES ISSUES STATEMENT

DATeline: ATLANTA, Oct. 3

KEYWORD: bc-electromag-sciences

BODY:

The following announcements were made today by Electromagnetic Sciences Inc. (NASDAQ: ELMG):

(a) The company has undertaken a program to strategically restructure resources in its microwave operations, which will result in a special charge of approximately \$3.4 million to operating income in the third quarter ended Sept. 30. The company expects its restructuring program to contribute to improved productivity and profitability in 1991 and future periods.

(b) The company has adopted a long-term objective of increasing the visibility and independent stature of its LXE subsidiary, and thus expects to effect a public offering of stock in its LXE subsidiary when market conditions are appropriate.

(c) The company will seek to repurchase up to 1 million shares of its currently outstanding 7,077,000 shares of common stock.

RESTRUCTURING PROGRAM

The company said that operations in the third quarter before the restructuring charge produced approximately the same result as for its second quarter. Thus the company expects to report an after-tax loss of approximately \$1.95 million for the third quarter, or \$.28 per share. Announcement of the final third quarter results is expected near the middle of October. While the company does expect normal operations to show improvement in the fourth quarter compared to the earlier quarters, the year as a whole will show a loss as a result of the restructuring charge.

Dr. John E. Pippin, chairman and CEO, made the following statement: "We believe that our restructuring program will allow our microwave operation to achieve significant improvements in efficiency and productivity and position us to return to a more rewarding level of profitability in our marketplace.

"Recognizing the increasing pressures in the defense market, we have for some time pursued a strategy based on diversification of our markets towards commercial and international sales, intensification of research and development effort, and careful management of resources. I believe that this strategy is producing positive results. Revenues for products directed toward U.S. government end-use in 1987 were 75 percent of the total, while

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commercial and international revenues accounted for 25 percent of the total. In 1988, the commercial and international share rose to 32 percent, in 1989 it was 41 percent. In the first six months of 1990, commercial and international revenues were 46 percent of the total. And 52 percent of the orders received in the first six months of 1990 were in the commercial and international arena.

"Our R&D efforts have allowed us to introduce innovative proprietary concepts for the design and manufacture of ferrite phase shifters and switch networks having attractive size, weight, performance, and cost advantages. These have significant potential in both commercial and military satellites, and the phase shifters are being produced in very large quantities on a current defense program for airborne phased array radars, a program that is expected to continue for many years.

"These and other technologies provide us the opportunity to participate in the emerging commercial satellite markets. Our hybrid and monolithic technologies are being applied to complex switching networks for a major commercial satellite program. In addition, we recently received a small study contract from Satellite Communications, a Strategic Business Unit of Motorola, to develop a 'proof-of-concept' planar phased array antenna for the Iridium Satellite system, using similar technologies.

"Our commitment to quality in our manufacturing processes has helped us win multi-million dollar programs for manufacture of hardware for spacecraft, missiles, and anti-submarine warfare systems. And we have recently learned that the company expects to receive contracts in the fourth quarter for initial development of hardware for two electronic warfare systems which appear to have significant potential for production orders in future years.

"So, as reflected by orders and revenues, our strategy is producing positive results in diversification of markets while strengthening our position in the defense area. And, as previously stated, profitability is expected to improve in the fourth quarter.

"But as we enter the 1990s, it is becoming clear that, to be truly successful in our microwave business, we must improve our productivity, provide more efficient systems for manufacturing and testing our products, and streamline our management organization to provide effective and immediate attention to opportunities provided by our customers as well as more efficient direction of internal operations. In large part these needs are brought on by declining defense budgets and a U.S. government appetite for increasingly complex hardware at a lower price. They are also a result of opportunities to apply our new technologies in small commercial satellites, if our production of satellite hardware can move from 'hand-crafting' to more efficient production lines.

"Therefore, I have directed that our microwave operation undertake an aggressive program to consolidate its facilities, eliminate excess capacity, and streamline its management and organizational structure, in a manner consistent with the nature and quantity of business opportunities that we now foresee. I have also directed that our microwave operation improve its manufacturing and test processes and tooling to provide cost-effective, high-performance solutions for future requirements of the military and commercial satellite markets. These actions will result in a charge of approximately \$3.4 million to operating income in the

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